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10/544,129

08/02/2005

Satoshi Takei

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OLIFF & BERRIDGE, PLC

P.O. BOX 320850

ALEXANDRIA, VA 22320-4850

EXAMINER

EOFF, ANCA

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|-------------------------------------|--|
| Office Action Summary | Application No. 10/544,129 | Applicant(s) TAKEI ET AL. | |
| | Examiner ANCA EOFF | Art Unit 1795 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08/02/2005, 06/19/2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>06/19/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The foreign priority document JP 2003-044045, filed on February 21, 2003 was received and acknowledged. However, in order to benefit of the earlier filing date, a certified English translation is required.
2. Claims 1-10 are pending in the application.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 refers to the structural unit of formula (1) but the claim does not include the formula (1).

The claim contains the term “only” when referring to structural units of formula (1) and structural units of formula (2) in a polymer. This does not make sense. It is not clear what applicant intends.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined

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application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1, 3, 6 and 8 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2, 6, 10 and 12 of copending Application No. 10/540,389. Although the conflicting claims are not identical, they are not patentably distinct from each other because they both claim a gap fill material forming composition used in manufacture of a semiconductor device having a hole aspect ratio of 1 or more, said gap fill material forming composition comprising a polymer with hydroxyalkyl acrylate or hydroxyalkyl methacrylate as repeating unit and a crosslinking agent with at least two crosslink-forming functional groups.

The polymer containing hydroxyalkyl acrylate or hydroxylalkyl methacrylate as repeating unit is equivalent to a polymer comprising the unit (1) of the instant application, wherein $q=0$ and R_2 is a hydrogen atom.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-2 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Sono et al. (GB 1 496 345).

With regard to claim 1, Sono et al. disclose resinous coating composition comprising a polymer of hydroxyl-lower alkyl acrylates or hydroxyl-lower alkyl methacrylates (page 2, lines 4-5), such as polymers of 2-hydroxyethyl acrylate, 2-hydroxyethyl methacrylate, 2-hydroxypropyl acrylate, 2-hydroxypropyl methacrylate, 3-hydroxypropylacrylate and 3-hydroxypropyl methacrylate (page 2, lines 50-53).

The resinous coating composition further comprises a solvent and crosslinking agents (page 2, lines 58 and 61).

Sono et al. specifically disclose a composition comprising poly(2-hydroxyethyl methacrylate) with average molecular weight of 40,000, hexamethoxymethylolmelamine as crosslinking agent and ethylene glycol monomethyl ether as solvent (Example 3, page 10).

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The poly(2-hydroxyethyl methacrylate) meets the limitation of claim 1 of the instant application, being equivalent to the polymer comprising only units of formula (1), wherein R_1 is a methyl group, $p=1$, $q=0$ and R_2 is a hydrogen atom.

Since Sono et al. do not mention any fractions of lower molecular weight in the poly(2-hydroxyethyl methacrylate), it is the examiner's position that the poly (2-hydroxyethyl methacrylate) of Sono et al. meets the limitation of the instant application for components having a molecular weight of 3,000 in a rate of 20% or less.

In claim 1 of the instant application, the limitation "the composition is used in manufacture of semiconductor device by a method comprising coating a photoresist on a semiconductor substrate having a hole with aspect ratio shown in height/diameter of 1 or more and transferring an image to the semiconductor substrate by use of lithography process" is an intended use of the composition and adds no patentable weight to the claim.

Therefore, the resinous composition of Sono et al. is equivalent to the gap fill material forming composition of the instant application.

With regard to claim 2, Sono et al. also disclose a composition comprising a copolymer of 2-hydroxyethyl methacrylate and methyl methacrylate (95:5 molar ratio) with average molecular weight of 40,000, pyromellitic anhydride as crosslinking agent and ethylene glycol monomethyl ether as solvent (Example 4, page 11).

The copolymer of 2-hydroxyethyl methacrylate and methyl methacrylate meets the limitation of claim 2 of the instant application, being equivalent to the

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polymer comprising only units of formula (1), wherein R_1 is a methyl group, $p=1$, $q=0$ and R_2 is a hydrogen atom and units of formula (2), wherein R_1 and R_3 are methyl groups.

Since Sono et al. do not mention any fractions of lower molecular weight in the copolymer of 2-hydroxyethyl methacrylate and methyl methacrylate, it is the examiner's position that the copolymer of 2-hydroxyethyl methacrylate and methyl methacrylate of Sono et al. meets the limitation of the instant application for components having a molecular weight of 3,000 in a rate of 20% or less.

In claim 2 of the instant application, the limitation "the composition is used in manufacture of semiconductor device by a method comprising coating a photoresist on a semiconductor substrate having a hole with aspect ratio shown in height/diameter of 1 or more and transferring an image to the semiconductor substrate by use of lithography process" is an intended use of the composition and adds no patentable weight to the claim.

Therefore, the resinous composition of Sono et al. is equivalent to the gap fill material forming composition of the instant application.

With regard to claim 6, Sono et al. disclose that one of the crosslinking agents used in the resinous composition may be partially methylated hexamethylolmelamine, wherein an average of 3.6 functional groups are methylated and the remaining 2.4 groups are in the form of $-OH$, $-COOH$ or $-CHO$ (page 4, lines 31-33).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-6 and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takei et al. (WO 02/05035, wherein the citations are from the English equivalent document, US Pg-Pub 2003/0146416).

With regard to claims 1 and 3, Takei et al. disclose a composition for forming a gap-filling material for lithography, wherein said material is used for producing semiconductor devices by a method using the gap filling material to apply the resist on a substrate having holes with an aspect ratio of 1 or more, to transfer images onto the substrate by utilization of lithographic process (abstract). The composition for forming a gap-filling material comprises a polymer and a solvent (abstract).

Takei et al. further disclose that the polymer is preferably a polymer that contains at least one or more hydroxyl groups per repeating unit and examples thereof include thermoplastic polymers obtained by polymerizing compounds having one ethylenically unsaturated bond in the molecule, such as hydroxyalkyl acrylates or hydroxyalkyl methacrylates (par.0061).

As hydroxyalkyl acrylates, Takei et al. specifically disclose : hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application,

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wherein R_1 is a hydrogen atom, $p=1$, $q=0$ and R_2 is a hydrogen atom), hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, $p=2$, $q=0$ and R_2 is a hydrogen atom) and hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, $p=3$, $q=0$ and R_2 is a hydrogen atom) (par.0064).

As hydroxyalkyl methacrylates, Takei et al. specifically disclose hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, $p=1$, $q=0$ and R_2 is a hydrogen atom), hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, $p=2$, $q=0$ and R_2 is a hydrogen atom), hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, $p=3$, $q=0$ and R_2 is a hydrogen atom) (par.0065).

While Takei et al. do not specifically disclose a polymer comprising only units derived from the hydroxyalkyl (meth)acrylates mentioned above, it would have been obvious to one of ordinary skill in the art at the time of the invention to obtain such a polymer, based on Takei's teachings that polymers comprising at least one hydroxyl group per repeating unit may be obtain by polymerizing ethylenically unsaturated compounds such as hydroxyalkyl acrylates or hydroxyalkyl methacrylates (par.0061).

Takei et al. further disclose that the weight average molecular weight of the polymer is preferably between 1,000 and 30,000 (par.0060).

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With regard to claim 2, Takei et al. disclose a composition for forming a gap-filling material for lithography, wherein said material is used for producing semiconductor devices by a method using the gap filling material to cover the resist on a substrate having holes with an aspect ratio of 1 or more, to transfer images onto the substrate by utilization of lithographic process (abstract). The composition for forming a gap-filling material comprises a polymer and a solvent (abstract).

Takei et al. further disclose that the polymer is preferably a polymer that contains at least one or more hydroxyl groups per repeating unit and examples thereof include thermoplastic polymers obtained by polymerizing compounds having one ethylenically unsaturated bond in the molecule, such as hydroxyalkyl acrylates or hydroxyalkyl methacrylates (par.0061).

As hydroxyalkyl acrylates, Takei et al. specifically disclose hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, $p=1$, $q=0$ and R_2 is a hydrogen atom), hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, $p=2$, $q=0$ and R_2 is a hydrogen atom), hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a hydrogen atom, $p=3$, $q=0$ and R_2 is a hydrogen atom) (par.0064).

As hydroxyalkyl methacrylates, Takei et al. specifically disclose hydroxyethyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, $p=1$, $q=0$ and R_2 is a hydrogen atom),

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hydroxypropyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, $p=2$, $q=0$ and R_2 is a hydrogen atom), hydroxybutyl acrylate (equivalent to the compound of formula (1) of the instant application, wherein R_1 is a methyl group, $p=3$, $q=0$ and R_2 is a hydrogen atom) (par.0065).

Takei et al. further disclose that the above-mentioned polymer can be copolymerized with an uncrosslinkable monomer, so that the dry-etching speed and reflectivity can be finely adjusted (par.0071) and such co-polymerizable monomer includes a compound with ethylenically unsaturated bonds, such as acrylic and methacrylic esters (par.0071). The acrylic and methacrylic esters are alkyl acrylates and alkyl methacrylates having alkyl groups of 1 to 10 carbon atoms.

While Takei et al. do not specifically disclose a polymer comprising only units derived from the hydroxyalkyl (meth)acrylates and the alkyl (meth)acrylates mentioned above, it would have been obvious to one of ordinary skill in the art at the time of the invention to obtain such a polymer, based on Takei's teachings that polymers comprising at least one hydroxyl group per repeating unit may be obtain by co-polymerizing ethylenically unsaturated compounds such as hydroxyalkyl acrylates or hydroxyalkyl methacrylates (par.0061) with uncrosslinkable monomers, such as alkyl acrylates or alkyl methacrylates in order to finely adjust the reflectivity and dry etching speed (par.0071).

With regard to claims 4-5, Takei et al. disclose that the solvent used for the composition for forming gap-filling material preferably has a boiling point in

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the range of 145-220°C (par.0098) and may be butyl lactate, cyclohexanone, propylene glycol monobutyl ether or propylene glycol monomethyl ether acetate (par.0097).

With regard to claim 6, Takei et al. disclose that the crosslinker used for the composition for forming gap-filling material has at least two cross-linking forming functional groups (par.0095).

With regard to claims 8-10, Takei et al. disclose a semiconductor device manufacturing method comprising the following steps:

- a step (A) in which the composition for gap-filling material is applied to a substrate having holes with an aspect ratio of 1 or above and then is dried to form a planarized filling layer on the substrate (par.0107);

- a step (B) in which the resist is applied and dried (par.01018), and

- a step (C) in which an exposure and development are performed (par.0109).

Takei et al. also disclose that a bottom anti-reflective coating can be formed before or after the formation of the filling layer using the composition for forming gap-filling material in the above step (A) (par.0109).

11. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takei et al. (WO 02/05035, wherein the citations are from the English equivalent document, US Pg-Pub 2003/0146416) as applied to claim 1 above and in further view of Rutter et al. (US Pg-Pub 20020110665).

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With regard to claim 7, Takei et al. teach the composition for forming a gap-filling material of claim 1 (see paragraph 10 of the Office Action) but fail to teach that the composition comprises an acid or an acid generator.

Rutter et al. disclose an aperture fill material, comprising a cross-linkable polymer with hydroxyl groups, one or more crosslinking agents, one or more acid catalysts and a solvent (par.0026).

The acid catalysts are added to the composition to catalyze the crosslinking of the polymer and crosslinking agent (par.0051) and may be free acids or acid generators.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include the acid catalysts (free acid or acid generators) disclosed by Rutter et al. in the composition for forming a gap-filling material of Takei et al., in order to catalyze the crosslinking of the polymer and crosslinking agent.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Crivello (US Patent 4,610,952) discloses a blend comprising a solvent, a resist composition comprising a water soluble hydroxyl-containing film forming organic oligomer and an onium salt (acid generator) (column 1, lines 54-60). The water-soluble hydroxyl functional film oligomer may be poly-2-hydroxyethylacrylate (column 4, lines 40-46). The blend may further comprise

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additives such as trimethyloliscyanurate, dimethylourea and dimethylolthiourea which increase crosslink density and improve the physical properties of the cured blend (column 5, lines 25-30). In addition to being employed as photoresist, the curable composition may be used to make planographic printing plates, name plates, metalographic etch resists and conformal coatings (column 5, lines 30-34).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANCA EOFF whose telephone number is (571)272-9810. The examiner can normally be reached on Monday-Friday, 6:30 AM-4:00 PM, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service

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Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. E./

Examiner, Art Unit 1795

/Cynthia H Kelly/

Supervisory Patent Examiner, Art Unit 1795